

**REMARKS**

Claims 1, 3-7 and 19-36 are pending in this application. Claim 1 is herein amended. Reconsideration of the rejections in view of these amendments and the following remarks is respectfully requested.

**Rejections under 35 USC §103(a)**

**Claims 1, 7 and 31 were rejected under 35 USC §103(a) as being obvious over Uglow et al (U.S. Patent No. 6,251,770) in view of Yew et al (U.S. Patent No. 5,801,094).**

Applicants respectfully traverse this rejection.

Claim 1, lines 16-17 has been amended to shift the position of “in said first kind of the insulating layer” to clarify that the cross sectional area gradually increases toward the upper level in said first kind of the insulating layer. The Office Action already interprets claim 1 in this way, as mentioned above. Such an amendment does not introduce any new matter or new issue.

The Office Action alleged that “Uglow et al. teaches **all the limitations** in the claim with the **exception** of the contact hole having a portion whose cross sectional area gradually increases toward an upper level in the first kind of insulating layer and a portion with uniform cross sectional area connected below the upper portion.” The Office Action further alleged as follows:

It would have been obvious to one of ordinary skill in the art to use a contact hole having a gradual increase toward an upper level as Yew et al. teaches that this is well known and conventional in the art, and an inherent result of the gradual increase is a conformal barrier layer that aids in the adhesion of the embedded conductive layer while preventing the diffusion of the embedded layer, furthermore it would have been obvious to one of ordinary skill in the art to use a tapered edge or gradual increase from the hole to the trench in order to enhance the ability to fill the openings within the insulating film and reducing the propensity to form an over hang over the opening as is the disclosed intended purpose of Yew et al.

Claims 1 and 31, however, further recite, among other things, “wherein said interlayer insulating film includes a **first kind of an insulating layer surrounding said side wall and said bottom surface of said wiring trench** and a **second kind of an insulating layer disposed under said first kind of the insulating layer and having etching characteristics different from said first kind of the insulating layer.**”

In Yew et al, if it is assumed that the intermetal dielectric layer 58 is made of a first kind of an insulating layer, the first kind of the insulating layer 58 does not surround the bottom surface of the wiring trench, but the second kind of the insulating layer 54 surrounds the bottom surface of the wiring trench. Such a structure of the trench is similar to Fig. 1 of Uglow et al., which is labeled as the prior art. Thus, there is no reason or motivation for a person of ordinary skill in the art to combine the structures of Uglow et al and Yew et al.

Because Uglow et al and Yew et al have different wiring trenches, and the manufacturing processes of these are also different from each other, these two different structures cannot be simply combined together.

For at least these reasons, claims 1 and 31 patentably distinguish over Uglow et al and Yew et al. Claim 7, depending from claim 1, also patentably distinguishes for at least the same reasons.

More specifically, the Office Action admits that Uglow et al does not teach the contact hole having a (an upper) portion whose cross sectional area gradually increases toward an upper

level in the first kind of insulating layer and a portion with uniform cross sectional area connected below the upper portion. Yew et al, Figs. 19-21, is cited to supplement this deficiency.

The Office Action appears to neglect the differences in structure between Uglow et al and Yew et al, and concentrate on the shape of the contact hole with tapered edge 72. The Office Action appears to allege that Yew et al teaches that the tapered edge is preferred and if the main etching does not form a taper 72, an isotropic etching may be included after the etching of the dielectric layer 52, and hence that it would be obvious to add such measure to produce a taper in the structure of Uglow et al.

Here, it should be noted that the overhang over the opening 68 (see Fig. 19) can be formed since the silicon nitride etch stop layer 54 (c.f. column 6, lines 1-7) has a lower etching rate than that of the underlying dielectric oxide layer 52. If an overhang is formed, the barrier layer to be formed by sputtering will not deposit on the retarded portion under the overhang. This is not good, and it is preferred "to form a tapered sidewall on the openings in the etch stop layer" (column 8, lines 15-16). Thus, Yew et al's teaching should be interpreted under the condition of the presence of an etch stop layer 54 for stopping the trench etching. In Fig. 10B of Uglow et al, there is no such etching stopper for stopping etching of the trench. Referring to Fig. 7, Uglow et al describes in column 6, lines 30-36 "the trench 110 is first etched E1 using a first etch chemistry that is optimized to etch the lower K dielectric material 106'. ... The trench depth is preferably calculated using a timing technique which determines when etching operation should stop." (i.e. controlled etching). There is no motivation to form an overhang, and no necessity to prevent such an overhang.

Further, applicant's claim 1 recites "said contact hole has an upper portion whose cross sectional area gradually increases toward an upper level in said first kind of the insulating layer". The Office Action admits this in the Action (page 3, lines 4-5). The tapered edge portion of Yew et al is at the etch stopper layer, and not in the dielectric layer 58. The etch stopper layer has a different etching characteristics than the dielectric layers 58 and 52. The tapered edge portion of the applicant's claim 1, and any tapered edge portion in the dielectric layer 106' in Uglow et al is not taught.

Thus, claims 1, 7 and 31 patentably distinguish over Uglow et al and Yew et al.

Thus, the 35 USC §103(a) rejections should be withdrawn.

**Claims 3-6, 19-26 and 32 were rejected under 35 USC §103(a) as being obvious over Uglow et al in view of Yew et al and further in view of Tsai et al (U.S. Patent No. 6,319,814).**

**Claims 27-30 and 33-36 were rejected under 35 USC §103(a) as being obvious over Uglow et al in view of Yew et al and further in view of Huang (U.S. Patent No. 6,096,595).**

Applicants respectfully traverse these rejections.

Tsai et al is cited for allegedly disclosing a third kind of insulating layer under the second kind of insulating layer. Huang is cited for allegedly disclosing interconnection of a semiconductor device having a dual damascene structure. The disclosures of Tsai et al and Huang, however, do not remedy the deficiencies of Uglow et al and Yew et al discussed above.

For at least these reasons, claims 3-6 and 19-30, depending from claim 1, and claims 32-36, depending from claim 31, also patentably distinguish over the cited references.

Thus, the 35 USC §103(a) rejections should be withdrawn.

Serial No. 09/735,479  
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Reply to Office Action of January 29, 2004

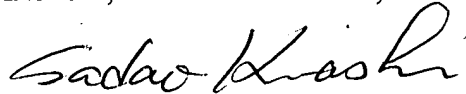
In view of the aforementioned amendments and accompanying remarks, Applicant submits that the claims, as herein amended, are in condition for allowance. Applicant requests such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP



Sadao Kinashi  
Attorney for Applicant  
Registration No. 48,075

SK/fs  
1250 Connecticut Avenue, NW  
Suite 700  
Washington, D.C. 20036  
(202) 822-1100

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